DISPENSER ACTIVATION METHOD AND APPARATUS

Field of the Invention

[0001] The invention relates to the field of fuel dispensers. More particularly, the invention is related to detecting the position of a fueling nozzle of a fuel dispenser. This application claims priority from a provisional application, serial no. 60/456,203, filed March 21, 2003.

Background of the Invention

[0002] Most states require that fuel dispensers be configurable to require the operator of the fuel dispenser (i.e., a self-service customer or a service station attendant) to perform at least two operations before allowing a fueling or dispensing transaction to begin. One required operation is for the operator to select the type or grade of fuel. The other required operation is for the operator to actuate a switch to activate the dispensing transaction. With most dispensers, the order or sequence in which these operations are completed is irrelevant.

[0003] The selection of a grade of fuel is typically implemented by requiring the operator of the fuel dispenser to select a grade or type of fuel by depressing a fuel grade button. The fuel grade button is usually implemented as a mechanical switch but may sometimes be a graphic button on a touch screen display.

[0004] The actuation of a switch to activate the dispensing transaction is typically implemented by one of several fuel dispenser designs. In one design, the fuel dispenser includes a mechanical lever that may be moved between an "UP" position and a "DOWN" position. In the UP position, the mechanical lever blocks the opening of a holster, thereby preventing insertion of a fueling nozzle. In the DOWN position, the mechanical lever does not

block the opening of the holster and is blocked from moving into the UP position by the fueling nozzle if it is located in the holster.

[0005] To dispense fuel, the operator removes the fueling nozzle from the holster and then manually lifts the mechanical lever into the UP position. By lifting the lever into the UP position, the operator actuates a switch that activates the dispensing transaction. After dispensing fuel, the operator must manually lower the mechanical lever to the DOWN position to no longer block the opening of the holster in order to replace the nozzle into the holster. By lowering the mechanical lever to the DOWN position, the operator actuates a switch that terminates the dispensing transaction.

[0006] In another fuel dispenser design, the fuel dispenser includes a mechanical flapper-switch mechanism inside the holster and a mechanical or a graphical display activation button. To dispense fuel, the operator depresses the mechanical or graphical display activation button which activates the dispensing transaction. The operator then dispenses fuel via the fueling nozzle. After dispensing fuel, the operator returns the fueling nozzle to its holster. The insertion of the fueling nozzle into its holster causes the nozzle to contact and move the flapper-switch mechanism. This movement of the flapper-switch mechanism actuates a switch which terminates the dispensing transaction.

[0007] In yet another fuel dispenser design, the fuel dispenser again includes a mechanical flapper-switch mechanism inside the holster. To dispense fuel, the operator removes a fueling nozzle from its holster from a position where it was blocking movement of the flapper-switch mechanism. When the nozzle is removed from the holster, the mechanical flapper mechanism moves outward and actuates a switch to activate the dispensing transaction. After dispensing fuel, the operator returns the fueling nozzle to its holster, thereby pushing the flapper-switch mechanism into the holster which actuates a switch and terminates the fuel dispensing transaction as described above.

[0008] The conventional fuel dispensers described above use button switches, lever switches or flapper switches to activate and/or terminate dispensing transactions. Such switches are mechanically activated and, as such, are prone to failure over time after repeated use due to

mechanical wear. In addition, these mechanical switches include numerous components that make them complicated and expensive to manufacture, install and repair. Further, conventional fuel dispenser designs can be confusing or difficult for an operator to operate because they require the operator to consciously carry out two separate operations before the fueling transaction may begin.

[0009] A need, therefore, exists for an improved fuel dispenser having a simpler operator interface and a non-mechanical apparatus for activating and/or terminating a fuel dispensing transaction.

Summary of the Invention

[0010] The present invention is a fuel dispenser that includes a proximity sensor that determines when a fueling nozzle is positioned within a holster and when the fueling nozzle is removed from the holster. The proximity sensor generates a proximity signal that indicates the position of the nozzle. A switching device receives the proximity signal and activates or terminates a fuel dispensing transaction based on the determined position of the fueling nozzle as indicated by the proximity signal.

[0011] According to one aspect of the invention, the proximity sensor is a capacitive proximity sensor that detects changes in capacitance.

[0012] According to another aspect of the invention, the proximity sensor communicates the proximity signal to the switching device via a wired connection.

[0013] According to another aspect of the invention, the proximity sensor communicates the proximity signal to the switching device via a wireless connection.

[0014] According to yet another aspect of the invention, the holster is non-metallic and the nozzle comprises a metal.

Brief Description of the Drawings

[0015] For the purpose of illustrating the invention, there is shown in the drawings a form that is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

[0016] Figure 1 is a front plan view of a fuel dispenser according to an exemplary embodiment of the present invention.

[0017] Figure 2 is a side plan view of a fuel dispenser according to an exemplary embodiment of the present invention.

[0018] Figure 3 is a side cross-sectional view of a fuel dispenser according to an exemplary embodiment of the present invention.

Detailed Description of the Invention

[0019] Referring to the drawings, wherein like reference numerals illustrate corresponding or similar elements throughout the several views, there is shown in Figures 1-3 a fuel dispenser 100 according to the present invention. A fueling nozzle 104 is coupled to a fuel source (not shown) via a fueling hose 106. The fueling nozzle 104 may dispense fuel from the fuel source when a fueling transaction is activated and may not dispense fuel when a fueling transaction is terminated.

[0020] The fueling transaction is activated or terminated based on certain factors. Such factors include whether the fueling nozzle 104 is located in or removed from its nozzle boot 102 or holster. When the fueling nozzle 104 is removed from the holster 102, the fuel dispenser 100 may activate the fueling transaction provided that any other requirements or criteria, such as confirmation of payment, are satisfied. When the fueling nozzle 104 is returned to the holster 102, the fuel dispenser 100 terminates the fueling transaction.

[0021] The fuel dispenser 100 includes a non-mechanical proximity sensor 108 that is mounted on or near the holster 102. The proximity sensor 108 automatically detects whether the fueling nozzle 104 is removed from or replaced into its nozzle boot 102 or holster. The proximity sensor 108 indicates the position of the fueling nozzle 104 on a proximity signal that it transmits on a signal connection 112 to a non-mechanical switching device 114. The signal connection 112 may be a wired connection, an optical fiber connection, or a wireless (e.g., infrared, radio frequency, ...) connection. The non-mechanical switching device 114 activates and/or terminates the fuel dispensing transaction based on the indicated position of the fueling nozzle 104.

[0022] The proximity sensor 108 and the switching device 114 do not have moving parts that must be displaced by the removal and/or replacement of the fueling nozzle 104 from the holster 102. The invention provides improved reliability over conventional fuel dispensers by avoiding failure mechanisms that might otherwise result from mechanical wear that occurs after repeated use of mechanically-activated switches used to activate and/or terminate a dispensing transaction.

[0023] When the nozzle 104 is removed from the holster 102, the proximity sensor 108 sends a corresponding signal (the "REMOVED" signal) to the switching device 114 which may then activate the dispensing (or fueling) transaction in response to such signal. When the nozzle 104 is replaced into the holster 102, the proximity sensor 108 sends a corresponding signal (the "RETURNED" signal) to the switching device 108 that terminates the dispensing (or fueling) transaction.

[0024] A proximity sensor 108 may include a sensing element and conditioning circuitry for detecting the proximity of the nozzle 104 to the holster 102. In an exemplary embodiment, the sensing element generates a signal corresponding to the degree of proximity of the nozzle 104 to the holster 102. If the degree of proximity is greater than a predetermined threshold, the conditioning circuitry determines that the nozzle 104 is within the holster 102 and generates the RETURNED signal. If the degree of proximity is less than a predetermined threshold, the conditioning circuitry determines that the nozzle 104 is removed from the holster 102 and generates the REMOVED signal.

[0025] Alternatively, the proximity sensor may generate a proximity signal based on the detection of a transition from a proximate position to a distant position and vice versa. For example, when the proximity sensor 108 first detects a high proximity (i.e., nozzle is close to sensor) followed by a low proximity (i.e., nozzle is far from sensor), it may generate a REMOVED signal. When the proximity sensor 108 detects a low proximity followed by a high proximity, it may generate a RETURNED signal.

[0026] The use of transitions rather than a predetermined threshold may improve the system's reliability despite variations in the signal generated by the sensing element over time. The signal generated by the sensing element may vary over time and use due to factors including contamination of the sensing element (such as a covering of dirt) and wear of the fueling nozzle 104. This may cause an error if determining position of the nozzle 104 based on a predetermined threshold. For example, these factors may cause operating variations such that the signals generated by the sensing element corresponding to the nozzle 104 being in and out of the holster 102 are both above or both below the predetermined threshold. In contrast, determining position based on the transition will not result in an error because, although the characteristics of the transition may vary, the transition from low to high and high to low proximity signals still occurs.

[0027] The proximity sensor 108 may be implemented by one of various proximity sensor technologies, including inductive, capacitive, ultrasonic, and photoelectric technologies. The composition of the nozzle 104 and possibly the holster 102 will correspond to the particular proximity sensor technology. For example, the nozzle 104 will be comprised of a metal if the proximity sensor 108 is an inductive proximity sensor.

[0028] In an exemplary embodiment, the proximity sensor 108 is a capacitive proximity sensor 108 that detects a difference in capacitance between when the nozzle 104 is positioned in the holster 102 and when the nozzle 104 is removed from the holster 102. In an exemplary embodiment, the nozzle 104 comprises a metallic material. In an exemplary embodiment, the holster 102 is made of a non-metallic material, such as plastic, to improve the detection capability and reliability of the capacitive proximity sensor 108 in detecting the position of the fueling nozzle 104.

[0029] In the embodiment illustrated in Figures 2 and 3, an electrode 110 is installed around the outside of the holster 102 to increase the sensitivity and expand the sensing area of the proximity sensor 108. This electrode 110 could be made of wire or foil (e.g., an aluminum foil tape).

[0030] The proximity sensor 108 may be implemented on a small circuit board that may be encapsulated in a potting compound. The switching device 114 may implemented by a computer or an application specific integrated circuit and may be located within the electronics compartment (i.e., head) of the fuel dispenser 100. Although the proximity sensor 108 and the switching device 114 are shown as two separate elements, they may be combined in a single unit mounted on the holster 102.

[0031] A fuel dispenser may include multiple nozzles and holsters, each corresponding to a different grade of fuel. In an exemplary embodiment, the characteristics of each nozzle are particular for nozzles corresponding to that grade of fuel. This way, the proximity sensor and switching device may determine whether the nozzle for one grade of fuel is returned to the holster for another grade of fuel. For example, with a capacitive proximity sensor, the metal content of the nozzles for each different grade of fuel may vary such that the proximity sensor may determine both proximity and the type of nozzle. Upon detection of misplacement of the nozzle, the switching device may generate an error signal to a station operator may correct the nozzle placement.

[0032] A fuel dispenser 100 according to the present invention may provide a simpler operator interface because the operator does not need to consciously carry out two separate operations before the fueling transaction may begin. The fuel dispenser 100 does not require any buttons to be depressed or levers to be actuated to activate or terminate a fueling dispensing transaction.

[0033] Other variations of the apparatus can be conceived that provide the beneficial results of the invention while not deviating from the basic design features described herein.